Maize grain supply and demand for the animal protein chain in the Rio Grande do Sul State, Brazil

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ABSTRACT: *The animal production system has been affected in the Rio Grande do Sul State by low maize production, mainly non-ruminants. The total demand is not well known and official data are inaccurate and underestimated. This research characterized and analyzed the maize grain demand and supply for animal feed in the last 15 years at the Rio Grande do Sul State. The state supply was obtained from governmental harvests measurement. The demand was obtained by the total animals (swine, poultry and dairy and beef cattle), while the total state demand was obtained using the relative national consumption from these segments in relation to the total. The current maize grain demand was at the order of 6 million tons for the feeding of swine, poultry and cattle, while total demand was between 9 to 12 million tons in the Rio Grande do Sul State. The state maize production supplied near half of the total demand for the animal protein chain, characterizing a significant deficit for this sector, providing instability and making this productive chain economically unfeasible in the state.*
Key words: *animal feed, maize production, swine, poultry, cattle.*

Oferta e demanda de milho para a cadeia da proteína animal no Rio Grande do Sul

RESUMO: *Os sistemas de produção animal tem sido severamente afetada no estado do Rio Grande do Sul pela baixa oferta de milho produzido a nível estadual, especialmente não-ruminantes. A demanda do setor não é conhecida e as estimativas oficiais são imprecisas e subestimadas. Assim, o objetivo deste trabalho foi caracterizar e analisar a demanda e a oferta do milho produzido no estado para a alimentação animal nos últimos 15 anos. A oferta estadual foi obtida pelo acompanhamento governamental das safras. A demanda por segmento (aves, suínos e bovino de leite e corte) foi obtida pelo tamanho do rebanho gaúcho, enquanto que a demanda total foi utilizando a mesma proporção do consumo nacional de milho em relação aos segmentos avaliados. A demanda atual de milho para a alimentação de suínos, aves e bovinos no Rio Grande do Sul é da ordem de 6 milhões de toneladas e a demanda total do estado situa-se entre 9 a 12 milhões de toneladas. A oferta estadual de milho supre pouco mais da metade da necessidade para a cadeia da proteína animal, caracterizando um déficit significativo para este setor, proporcionando instabilidade e inviabilizando economicamente esta cadeia produtiva no estado, uma vez que há alta demanda de importação de milho de outros estados.*
Palavras-chave: *alimentação animal, produção de milho, suínos, aves, bovinos.*

The Rio Grande do Sul State had been contributed significantly to the Brazilian production of corn in the 1970s, when it was the second/third position among the biggest producing states in Brazil, producing 13-15% of the total national production. In the 2020/2021 growing season, the state occupied the seventh position among the producing states, contributing only 3.3% of the national production (IBGE, 2021a). This performance led to a maize grain deficit production of 1.5 million tons per year (SECRETARIA DE AGRICULTURA, 2019a). The deficit has been mitigated by importing grain from other states, with maize production mainly in the off-season. The main exporter is the Mato Grosso State, which intends to use maize grain for ethanol production with a consumption of 2.2 million tons per year. This condition will increase the cost of the imported maize, increasing the evasion of foreign exchange from the Rio Grande do Sul due to taxes and logistics, which reached almost R\$ 400 million in 2018 (SECRETARIA DE AGRICULTURA, 2019a).
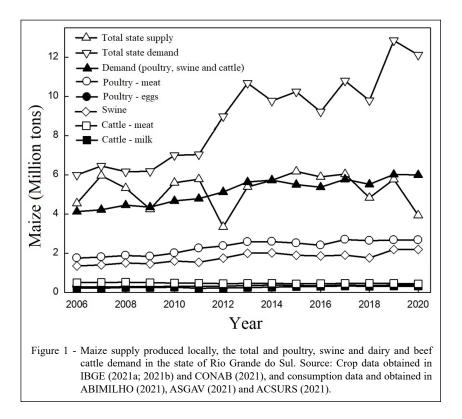
The maize grain limitation tends to become unsustainable for animal feed, which can be leading the entire chain to invest in self-sufficient states. It

can also harm an entire network of producers that survive in an integrated manner, generating income and employment in conditions of dependence on this crop production. The state also has internal issues that aggravate the situation when compare with other states, such as the consolidation of the maize and soybean is growing at the same season, making the maize production unfeasible, due to better soybean prices than maize. The state also had weather limitations to sown maize off-season. These factors lead maize costs to be higher for farmers in the Rio Grande do Sul, due to higher production costs and the cost for importing maize from the Midwest region.

This way, the limited maize grain supply affects the sustainability of several production chains in the state, with an emphasis on animal protein. Thus, this study characterized and analyze the maize supply and demand for the animal protein chain (poultry, swine, and dairy and beef cattle) in the last 15 years at the Rio Grande do Sul State.

The maize supply was obtained using indices of agricultural production available in the economic statistics of agriculture, livestock and others from the Brazilian Institute of Geography and Statistics - Base SIDRA (IBGE, 2021a; 2021b), and in the growing season forecasts from the National Supply Company (CONAB, 2021) for the last 15 years in the Rio Grande do Sul State. The state maize demand was obtained from the proportion of animals number in the state related to Brazil (IBGE, 2021b), where this relation was applied to the national consumption of maize available from the Brazilian Association of Maize Industries (ABIMILHO, 2021) for poultry, pigs and dairy and beef cattle. This approach was validated for beef and dairy cattle by multiplying the total animal number by the estimated daily corn consumption (average of 36.5 and 200 kg year^{-1} animal[-1] for beef and milk cattle, respectively). For poultry and pigs, the same procedures was used, based on the quantities supplied for annual consumption in the state by the State Poultry Association (ASGAV, 2021) and by the Swine Association of Rio Grande do Sul (ACSURS, 2021), respectively. The total maize demand was estimated by multiplying the number of animals in the Rio Grande do Sul by the national mean rate of animal consumption of maize over the last 15 years.

The maize supply had ranged between 3 and 6 million tons per year for the Rio Grande do Sul in the last 15 years, when considered the state production (Figure 1). The lowest supply was in the 2012/2013 and 2019/2020 growing seasons due to

Figure 1 - Maize supply produced locally, the total and poultry, swine and dairy and beef cattle demand in the state of Rio Grande do Sul. Source: Crop data obtained in IBGE (2021a; 2021b) and CONAB (2021), and consumption data and obtained in ABIMILHO (2021), ASGAV (2021) and ACSURS (2021).

water deficit. The water deficit is the mains limiting factor for maize production in the state (BATTISTI et al., 2012), where irrigation has a huge potential to avoid yield losses, especially if applied properly during the grain-filling period (BERGAMASCHI & MATZENAUER, 2014; SILVA et al., 2020). However, in the 2020/2021 growing season, there was no drought in the state and production was only 3.5 million tons (CONAB, 2021). In this case, other factors were not taken into account by farmers to improve yields, such as soil fertility, high potential genetically hybrids, pest and disease control, technical assistance, and adequate governmental policies (BATTISTI et al., 2020).

The maize demand for poultry and swine has been growing slowly in the state over the past 15 years (Figure 1), while cattle is stabilized, consuming near 600 tons per year, considering the sum of dairy and beef cattle. The current maize demand is 6 million tons for the animal protein chain in the state (Figure 1). However, this demand must be much higher, due to not account for other animals, industrial and human consumption, other uses, and grain losses, seed demand, exports, and stock updates.

In Brazil, the maize consumption by poultry, pigs and dairy and beef cattle represented 45.85% of the total supply for the country in 2020 (ABIMILHO, 2021). In the Rio Grande do Sul State, the current consumption was 6 million tons of maize by the poultry, swine and dairy and beef cattle. Considering the same proportion for total demand, it is possible to estimate a total maize demand between 9 to 12 million tons in the state (Figure 1), with a deficit much greater than the 1.5 million tons of grain per year estimated by the state government (SECRETARIA DE AGRICULTURA, 2019a). This estimative for the Rio Grande do Sul State was done due to the no reliable data available about the other uses of maize in the state.

The maize grain deficit is a current concern from the consumers, where this has not been proved by official data so far. Other estimations indicated that the state has been deficient in maize for at least 20 years, where the total demand in 2020 was near 6.5 million tons (COLUSSI, 2021). The animal protein production chain has been claiming that the deficit occurred for at least 30 years, where this maize deficit is one of the limiting factors for increase protein production in the state. The swine production had been increased 35% in the last 15 years (2006-2020) in the Rio Grande do Sul State. Conversely, Paraná State grown swine production in 55% in the same

period (IBGE, 2021b). The Rio Grande do Sul state had the same number of poultry 15 years ago as Paraná State. Currently, Paraná has 18% more poultry than Rio Grande do Sul.

The self-sufficiency maize supply helped Paraná to be the largest producer of animal feed in the country in 2020, while Rio Grande do Sul, occupied the 7th position in the 2020/2021 (SINDIRAÇÕES, 2020). The maize supply affects directly several production chains in the Rio Grande do Sul State. The state government is aware of this limitation and has recently created the Pro-Maize RS program, with broad and varied goals; however, the results are below expectations when considered the opinion of the production chains.

The state government indicated that the state grows maize with high production and well distributed among the municipalities (SECRETARIA DE AGRICULTURA, 2019b). However, almost of municipalities produce below 30 thousand tons and only four produced above 60 thousand tons (IBGE, 2021a). Despite being produced in almost all municipalities, production is very low and in the 2019/2020 growing seasons, the situation worsened with the decrease of 31.8% to the previous harvest, representing a decrease in the total maize supply of 1.83 million tons. The local supply was only 3.94 million tons. This scenario did not change in the 2020/2021 growing season, where the state produced 3.57 million tons, with a mean yield of 4,450 kg ha^{-1}, against a yield of 8,860 kg ha^{-1} in Paraná state (CONAB, 2021).

The animal protein production chain has been affected by this low state supply, limiting profits and expansion of protein production in the state. In 2019, the maize demand was 2.99 million tons for the poultry industry in the Rio Grande do Sul (ASGAV, 2021); 2.18 million tons for swine (ACSURS, 2021); and 0.9 million tons for cattle (personal information). The government recognized the strategic role of this crop for the sustainability of the animal protein production chain but is unaware of the real value of demand by this sector, which has been dying and has not grown for at least 30 years, anchored by the chronic lack of grain supply.

The mean maize produced was 5.23 million tons per year in the last 15 years for the state of Rio Grande do Sul, while the total demand was 8.88 million tons per year. In the same period, the demand for the animal protein chain (poultry, pork and beef) was 5.15 million tons per year, with a consumption rate of less than 0.5% per year in this period, limiting the growth of the chain and its economic viability.

DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

AUTHORS' CONTRIBUTIONS

The authors contributed equally to the manuscript.

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